NOTE II.

DESCRIPTIONS OF EARTHWORMS.

BY

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I.

Moniligaster Houtenii n. sp.,

a gigantic earthworm from Sumatra.

(Plate 1, fig. 1—3).

Some time ago our Museum received from Mr. van Houten a large earthworm, found on his coffee-plantation in Tapanoeli (Sumatra). Though we know gigantic earthworms (of more than 1 M. in length) to exist in several tropical countries: Ceylon (*Megascolex coeruleus* Templ.)[1], Cayenne (*Anteus gigas* Perr.)[2], Brasil (*Titanus brasiliensis* Perr.)[3], Cape Colony (*Microchaeta Rappi* Bedd.)[4] and Australia[5], I hitherto never heard of their presence in the Malayan Archipelago.

Our animal measures 1.50 M. in length; unfortunately it is not very well preserved, but rather soft and extended, so I think it will not be its exact length during its lifetime. The number of segments amounts to 443 and the body attains its greatest thickness in the anterior region, its circumference measuring here about 55 m.m. The wall of the buccal cavity is somewhat extruded, therefore I could not recognize the shape of the cephalic lobe. No clitellum is visible and the pori dorsales seem also to be

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1) Ann. and Mag. Nat. Hist. Vol. XV, 1845, p. 59.

2) Nouv. Arch. Muséum d'Hist. Nat. Vol. VIII, 1872, p. 50.

3) Id. id. p. 57.

4) Trans. Zool. Soc. Vol. XII, 1886, p. 63.

5) Fletcher, in Linn. Soc. N. S. Wales, Meeting 30 June 1886.

absent. The setae are arranged in pairs in 4 series; the distance between the dorsal and the ventral pair is half as large as that between the two ventral pairs. The setae (fig. 3) are small, about 1 m.m. long; they are faintly curved, almost straight, with the usual thickening in the middle of their length. Their distal extremity is provided with small undulating lines, perhaps due to the presence of narrow ribs, like in the setae of *Criodrilus.* At the ventral side of the body there are two couples of fissures, the first of them between the 8th and 9th ring, the second between the 11th and 12th segment, situated in a line with the dorsal pairs of setae; moreover I observed a pair of smaller pores on the 14th segment, in front of the ventral setae.

The internal anatomy (fig. 1) presents several points of interest; therefore I regret that the condition of the worm is insufficient for histological study, so that many gaps will appear in the description of the structure of different organs. The pharynx is attached to the body-wall by numerous septum-shaped muscular bands; the 6th—9th septum are extraordinary thick and muscular, fitting like funnels one into another. The following septa have the usual structure, but beginning with the 23rd septum, behind the gizzard, they are again strongly developed. A curious fact that I wish to call attention to, is the situation of the septa; these not always correspond exactly to the limit between two subsequent segments. I found the 10th septum not situated between the 10th and 11th ring, but fixed to the body-wall in the middle of the 11th segment; the 11th septum lies nearly on the boundary of the 12th and 13th segment and the 12th septum between the 13th and 14th ring, immediately in front of the 13th septum (see the following page). In the 9th segment on each side of the dorsal surface of the oesophagus is a kidney-shaped pouch, attached by a mesenterial fold to the posterior side of the 8th septum; each vesicle is furnished with a long, slender, coiled tube, communicating with the exterior by one of the above-mentioned pores between the 8th and 9th ring. I believe bundles of spermatozoa could be recognized within them and therefore these two pouches may be regarded as the spermathecae. In the 11th ring lie two long, narrow, tubular glands, opening on to the exterior by the fissures between the 11th and 12th segment; not only by their shape but also by their colour these bodies are quite agreeing with the prostate-glands of *Acanthodrilus* a. o., so that they undoubtedly correspond with them. I have not been able however to find out the vasa deferentia.

At the posterior side of the 10th septum there are attached two large, flat, pale brown organs, which I suppose may represent the seminal reservoirs (testes), although a microscopical examination did not reveal any trace of spermatozoa in them, but only the presence of innumerable gregarine-capsules. In the 14th segment the anterior septum bears a broad, brown vesicle 13 m.m. long and extending into the two following segments; this pouch has a glandular wall and is coated at the internal side with a dense net-work of blood-vessels. As stated before the 12th and 13th septum are placed close against each other; these two septa seem to form together on each side a sort of funnel, the inferior part of which communicates with one of the pores on the 14th ring. Although the ovaries could not be found, I suppose that this funnel may functionate as an oviduct and that the vesicle represents a receptaculum ovorum, as we find fixed to the oviduct of *Lumbricus*, *Criodrilus* a. o.

The nephridia (fig. 2) are very obvious, attached to the anterior septum of each segment; their external apertures lie in a line with the dorsal pairs of setae, but they are not plainly visible. The glandular portion of each nephridium consists of a loop, the two limbs of which are spirally wound round each other; this part of the organ opens into the distal portion of a long, wide coecum, which with its proximal end extends on to the middle of the dorsal wall of the intestine. The nephridium communicates with the exterior by a long and slender tube; but I have not been able to detect its internal opening.

About the vascular system I could observe, that the dorsal vessel has divided in the 11th segment in two tubes, lying quite close together, as in *Acanthodrilus*, *Megascolex* [1] a. o. according to Beddard's observations. In the 6th—11th segment there are transverse hearts, passing from the dorsal trunk to the ventral vessel; especially the two posterior pairs of them are very large. The intestine appears to be furnished in the 15th—22nd segment with four different gizzards, because its muscular wall is interrupted there by four fibrous annular intervals. In this remarkable disposition of the gizzard, our specimen agrees with the species of the genus *Moniligaster*. This genus was established by Perrier on a single specimen from Ceylon (*M. Deshayesi* Perr.) [2]; a second species (*M. Barwelli*) was afterwards described by Beddard [3]), who examined a number of examples collected in Manilla. According to the descriptions of Perrier and Beddard however there seems to exist rather a great difference in the disposition of the genital organs of the two species. *M. Deshayesi* Perr. should be characterized by the presence of two pairs of testes, situated at some distance from each other, in the 8th and 10th segment respectively. The vasa deferentia of the anterior pair of them open on to the exterior by a pore between the 7th and 8th segment and are furnished with two large glands, situated in the 7th ring. It might be suggested that these glands, considered by Perrier as accessory organs of the vasa deferentia, correspond to the copulatory pouches of our specimen; for in *M. Barwelli* Bedd. there is also in the 8th segment a pair of spermathecae, communicating with the exterior by a long and

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1) Proc. Royal Phys. Soc. Edinburgh, Vol. VIII, p. 424.
2) loc. cit. p. 130.
3) Ann. and Mag. Nat. Hist. Vol. XVII, 1886, p. 94.

coiled duct. The prostate-glands of *M. Houtenii* may perhaps be identical with the elongate, yellow reservoir (vesicule seminale), communicating with the second pair of testes in *M. Deshayesi* Perr. and opening exteriorly by a pore between the 10th and 11th ring. In *M. Barwelli* Bedd., like in our specimen, only a single pair of testes is to be found, furnished with a thin, coiled vas deferens, that opens on to the exterior between the 9th and 10th segment, in the vicinity of a small, oval gland (prostate).

Finally it may be pointed out, that besides the disposition of the gizzard, there are some other points in the structure of *M. Houtenii* in which it agrees with *M. Deshayesi*: 1° the structure of the skin in the anterior part of the body differs from that of the other segments by being much thicker (the hypodermis as well as the muscular layer), resembling somewhat, as stated by Perrier, the clitellum of other Lumbricinae; 2° the numerous transverse bands, having the appearance of septa, by which the pharynx is attached to the body-wall; 3° the absence of a clitellum. However on the last character (although also present in *M. Barwelli*) not much reliance can be placed, because it is a negative one and our specimen might be in an immature state. If our specimen belongs to the genus *Moniligaster*, as I believe, it undoubtedly represents a gigantic form, *M. Deshayesi* Perr. measuring 150 m.m. and *M. Barwelli* Bedd. only 37 m.m.

Rhinodrilus Tenkatei, n. sp.

(Plate 1, fig. 4—8).

We owe to the kindness of Dr. H. ten Kate, the well-known traveller, a number of earthworms from Surinam, which appear to be referable to the genus *Rhinodrilus*. This genus, belonging to Perrier's Lombriciens intraclitelliens[1]), is characterized by having the cephalic lobe prolonged in a small muzzle and by its setae, which, instead of being smooth, are provided with chitinous arches over their distal portion.

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[1]) loc. cit. p. 65.

Our examples are about as large as our common earthworm; the longest specimen measures 115 m.m. and the number of its segments is 160. The anterior third part of the body is cylindrical, but its posterior two-third is rather flattened. The cephalic lobe (fig. 4) has the shape of a little muzzle, 2 m.m. in length; however this character is not visible in all the spirit-specimens, in some of them the prostomium is entirely retracted, in others it looks like the cephalic lobe of a *Lumbricus*-specimen. The second segment is very short, but the ten following rings are very long, and marked by a transverse groove; those of the remaining part of the body have only half their length. The colour of the animal is usually reddish brown on the dorsum, yellowish at the ventral side, moreover several examples show an olive-green ring around the body from the 12th (11th)– 15th (16th) segment. The external apertures of the nephridia are very obvious, situated close behind the anterior margin of each ring, near the dorsal pair of setae; in the anterior segments, where the segmental orifices are the largest, they lie somewhat upwards from the dorsal bristles, but in the 13th and following segments they lie in one line with them. The first nephridiopore is visible on the 3rd ring; in front of this orifice there is a narrow, longitudinal groove, running over the second segment. The setae are arranged in 4 series; the distance between the two ventral pairs is somewhat larger than that between a ventral and a dorsal pair. In each dorsal pair the setae are placed close to each other, in the ventral pairs there is a distance of about $^1/_2$ m.m. between them.

The clitellum is fully developed only in two specimens and extends from the 20th (21st)—26th (27th) segment; at the dorsal side there is not much visible of the glandular development, but along the edge of the ventral side between the dorsal and ventral series of setae a glandular ridge occurs, consisting of 7 tubercula pubertatis. In Perrier's *Rhinodrilus paradoxus* the clitellum entends from the 19th—21st segment and is also characterized by a ridge-shaped thickening on each side of the ventral surface. In the 26th segment each ventral pair of setae is surrounded by a glandular wall and the setae themselves are modified in penial setae; therefore I suppose this segment contains the male genital orifices, though I was unable to recognize them with certainty and though in *R. paradoxus* these pores are situated much more forward, between the 19th and 20th ring. The penial setae (fig. 7*a*) are not only longer, but also straighter than the other ones; the usual thickening does not lie in the middle of the bristles, but in their inferior third and they have a length of 0.9 m.m., whereas the ventral setae are 0.6 m.m., and the dorsal ones only 0.42 m.m. in length. The distal end of each penial seta is peculiarly provided with semi-lunate excavations; in the ordinary setae (fig. 7*b*) these are not so apparent and only faint lines are visible. In one specimen the ventral setae of the 17th, 18th and 19th segment were also replaced by a fascicle of four bristles, quite similar to the penial setae. As was demonstrated by Hering[1]) and Beddard[2]) in *Lumbricus* and *Acanthodrilus* the modification of the setae is neither always confined to the setae in the neighbourhood of the genital orifices.

In dissecting our worm[3]) I was surprized by the enormous development of the nephridia in the anterior segments of the body (fig. 5); the first pair of them, belonging to the third segment, is the largest and consists of two vast glands, situated at the inferior side of the oesophagus and entending into the 9th ring. The six following pairs of

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1) Zeitschr. wissensch. Zoologie. Bd. VIII, p. 418.

2) Proc. Zool. Soc. 1886, p. 173.

3) A more detailed account of the anatomy of this species will be published elsewhere.

nephridia reach with the proximal extremity of their loop to the middle of the dorsal surface of the intestine. Each nephridium (fig. 8) has a long, tubular duct, forming a loop (*a*), which consists of a limb that ascends and one that descends along the wall of the intestine; the inferior portion of the descending limb is widened before passing into a narrower tube, which somewhat farther bends again, runs back till about half its length and forms here a new loop (*b*). The ascending limb of this loop leads into a thicker tube, which forms another large loop (*c*), of which the limbs are spirally wound around each other. The descending limb of this loop runs a short way parallel with the widened portion of the duct, forms again a U-shaped bend (*d*) and terminates in a narrow tubule, bearing at its end the funnel-shaped internal opening.

There are 3 pairs of spermathecae, opening on to the exterior between the 6th and 7th, the 7th and 8th, the 8th and 9th segment, close before the orifices of the nephridia; they consist of long, flat pouches, about equally broad over their whole length, only narrowing a little in the vicinity of their external opening. The anterior pair of them is the shortest, the posterior pair is the longest and extends over five segments. Perrier could find no trace of copulatory vesicles in *R. paradoxus*, as I suppose, because his specimens were in immature condition; in some of my specimens they are also absent. In the 12th and 13th segment lie two pairs of seminal reservoirs (testes); they consist of an oblong, kidney-shaped organ, furnished at the notch with a smaller lobe (fig. 6). Each pair of reservoirs is covered by a common membrane, in which are also enclosed the two ciliated rosettes of the sperm-ducts; the two sperm-ducts of each side unite on a short distance from the reservoirs in a single vas-deferens of which I was however unable to detect the terminal portion. Perrier observed in *R. paradoxus* only a single pair of seminal reservoirs, close behind the gizzard, enclosing also the ciliated rosettes of the vasa-deferentia. There is a single pair of ovaries; in examining a dissected animal I could not find them out, but by microscopical examination of transverse sections they are plainly visible. I believe they are situated in the 14th segment; however because the septa are strongly displaced by the development of the seminal reservoirs, it is difficult to determine their real situation. Each ovary is a lobed organ, fixed to the posterior surface of the anterior septum, on each side of the ventral vessel; they contain every gradation in development of the ova. Opposite each ovary, on the anterior side of the posterior septum, lies the funnel-shaped mouth of an oviduct, which, passing through the septum, opens on to the exterior in the line of the ventral setae. I could not identify any structure as a receptaculum ovorum.

The alimentary canal commences by a wide buccal cavity, passing into a large pharynx, which extends into the 5th segment and is attached to the body-wall by numerous radiating muscular bands. The wall of the pharynx is not only muscular, but contains in its posterior two-thirds a large glandular mass, very obvious in transverse sections, as described also in *Pontodrilus* 1) by Perrier. The oesophagus then follows, reaching into the 10th ring; its posterior boundary is marked by a large, muscular gizzard with the same nacreous appearance as in *Lumbricus* and extending over three segments. Behind the gizzard the tubular intestine commences and is furnished here on each side with six coecal diverticula, the first of which is divided in a superior and an inferior portion; in transverse sections these glands appear to be dilatations of the intestine, having their lumen divided by radiating folds of their wall in a great number of lamelliform cavities, resembling the structure of the oesophagean glands in *Lumbricus*. A rudimentary typhlosole seems to be present.

The vascular system consists of four main vessels: the dorsal trunk, two ventral vessels and a subneural vessel;

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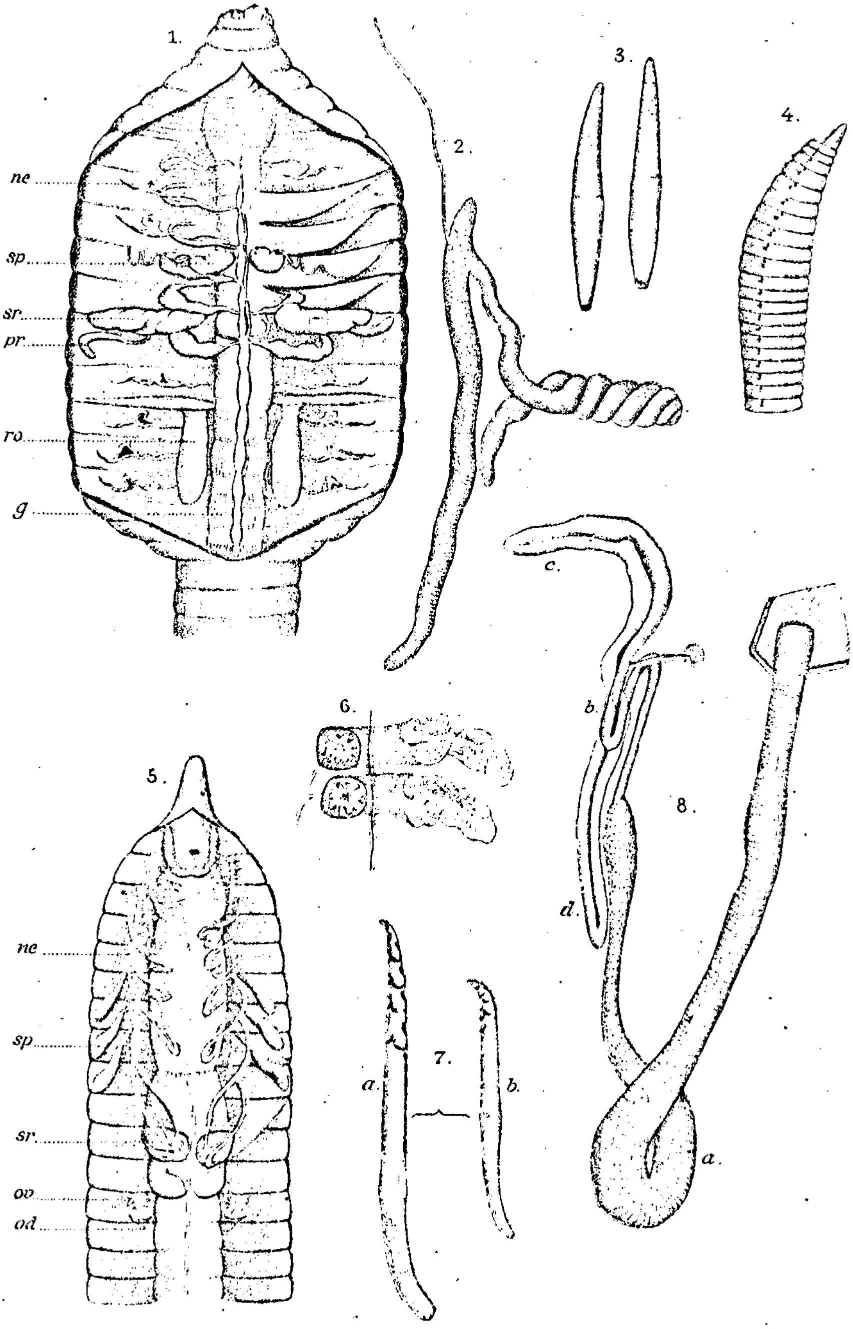
1) Arch. Zool. Expérim. T. IX, 1881, p. 197, pl. XVIII, fig. 40.

moreover there lies a typhlosolar trunk above the intestine behind the gizzard. The dorsal trunk is a simple tube, which in the region of the intestine appears to be ampullate and tubular anteriorly. In the 12th and 13th segment it gives off three pairs of large vessels, passing around the intestine. However the commissural vessels around the oesophagus, the »lateral hearts" seem to want here. The subneural vessel, which exists also in *Lumbricus*, but is absent in *Perichaeta* a. o., is a very thin tube, only visible in transverse sections. A vascular sinus could be detected around the intestine, between the muscular layer and the epithelium; from this sinus the blood is collected in a superior longitudinal vessel, the typhlosolar trunk. This trunk gives off between the 1st and 2nd, the 2nd and 3rd intestinal coecum, two pairs of large »intestinal hearts" passing around the intestine to the inferior ventral vessel. The superior of the two ventral vessels lies close beneath the intestine and seems to receive vessels, passing directly from the wall of the intestine.

EXPLANATION OF THE PLATE.

Fig. 1. General view of the contents of the body-cavity of *M. Houtenii* Horst (natural size); *ne.* nephridium; *sp.* spermatheca; *sr.* seminal reservoir; *pr.* prostate gland; *ro.* receptaculum ovorum?; *g.* gizzard.
Fig. 2. A nephridium of the same species. × 3 diam.
Fig. 3. A pair of setae of the same species. × 36 diam.
Fig. 4. Side view of the anterior portion of the body of *Rh. Tenkatei* Horst. × 2 diam.
Fig. 5. General view of the internal organs of the same species; the nephridia in the posterior segments have been omitted (× 4 diam.); *ne.* nephridium; *sp.* spermatheca; *sr.* seminal reservoir; *ov.* ovarium; *od.* oviduct.
Fig. 6. The two pairs of seminal reservoirs of the same; on the left side a great part of them has been removed to show the ciliate rosettes and the sperm-ducts.
Fig. 7. *a.* A penial seta; *b.* an ordinary seta of the same. × 50 diam.
Fig. 8. A nephridium of the same. × 23 diam.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Dr. R. Horst ad nat. del. H. Verlint lith. P. W. M. Trap impr.

1—3. Moniligaster Houtenii *Horst.*
4—8. Rhinodrilus Tenkatei *Horst.*